AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. Contract ID Code	Page	Of
Cost-Plus-Award-Fee	1	22

2. Amendment/Modification No.	3. Effective Date	4. Requisition/Purchase Req No.	5. Project No. (If applicable)
P00019	2003MAR20	SEE SCHEDULE	

6. Issued By Code W56HZV

TACOM
AMSTA-AQ-AHPA
FREDRICK T. SEEBURGER (586)574-8096
WARREN, MICHIGAN 48397-5000
HTTP://CONTRACTING.TACOM.ARMY.MIL
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7. Administered By (If other than Item 6) Code S0302A

DCMA PHOENIX
TWO RENAISSANCE SQUARE
40 N. CENTRAL AVENUE, SUITE 400
PHOENIX, AZ 85004-4400

SCD A **PAS** NONE **ADP PT** HQ0339

8. Name And Address Of Contractor (No., Street, City, County, State and Zip Code)

HONEYWELL INTERNATIONAL INC.
ENGINES & SYSTEMS
111 SOUTH 34TH STREET
PHOENIX AZ 85072-2181

TYPE BUSINESS: Large Business Performing in U.S.

Code 99193 **Facility Code**

☐ **9A. Amendment Of Solicitation No.**

9B. Dated (See Item 11)

☒ **10A. Modification Of Contract/Order No.**
DAAE07-00-C-N086

10B. Dated (See Item 13)
2000SEP20

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☐ **The above numbered solicitation is amended as set forth in item 14. The hour and date specified for receipt of Offers**
☐ **is extended,** ☐ **is not extended.**

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods: (a) By completing items 8 and 15, and returning _____ copies of the amendments: (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. Accounting And Appropriation Data (If required)
ACRN: BB NET INCREASE: $2,106,565.00

13. THIS ITEM ONLY APPLIES TO MODIFICATIONS OF CONTRACTS/ORDERS
It Modifies The Contract/Order No. As Described In Item 14.

KIND MOD CODE: G

☐	**A. This Change Order is Issued Pursuant To: The Changes Set Forth In Item 14 Are Made In The Contract/Order No. In Item 10A.**
☐	**B. The Above Numbered Contract/Order Is Modified To Reflect The Administrative Changes (such as changes in paying office, appropriation data, etc.) Set Forth In Item 14, Pursuant To The Authority of FAR 43.103(b).**
☒	**C. This Supplemental Agreement Is Entered Into Pursuant To Authority Of:** Mutual Agreement of Both Parties
☐	**D. Other (Specify type of modification and authority)**

E. IMPORTANT: Contractor ☐ **is not,** ☒ **is required to sign this document and return _____ copies to the Issuing Office.**

14. Description Of Amendment/Modification (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

SEE SECOND PAGE FOR DESCRIPTION

Except as provided herein, all terms and conditions of the document referenced in item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. Name And Title Of Signer (Type or print)		16A. Name And Title Of Contracting Officer (Type or print)	
		JOHN REGENHARDT REGENHAJ@TACOM.ARMY.MIL (586)574-6973	
15B. Contractor/Offeror	**15C. Date Signed**	**16B. United States Of America**	**16C. Date Signed**
_____ **(Signature of person authorized to sign)**		**By** /SIGNED/ **(Signature of Contracting Officer)**	2003MAR20

SECTION A - SUPPLEMENTAL INFORMATION

The purpose of this modification, P00019, is:

1. To revise the Scope of Work, reflecting the change in requirements from a Abrams-Crusader program, to an Abrams program. Previous notations of Crusader, it's OEM, UDLP, and Crusader specific requirements have been removed from the SOW. This revision also reduces previously required quantities of items, which have been agreed to between the parties (PCO letter dated 30 Sep 2002) and requires the submission of an approved termination proposal prior to the conclusion of this matter. This will result in a downward adjustment to the contract price. Additionally, the SOW is revised, for clarity purposes, in Section C.6. This change does not affect the estimated value of the contract.

2. To incorporate the Award Fee for the Fourth Award Fee Period. CLIN 0005AD in the amount of $2,106,565.00 is hereby incorporated for funding purposes. Section H-25 is revised as noted. Further revisions may be necessary at a later date.

Except as noted herein, all other terms, conditions and specifications of the contract remain unchanged and in full force and effect.

NOTE: FROM THE CONTRACT

REMOVE, DISCARD PAGE(S)	REPLACE, INSERT PAGE(S)
8a	8a
12	12
13-23a	13-23a
--	28n
35	35

*** END OF NARRATIVE A 021 ***

Name of Offeror or Contractor: HONEYWELL INTERNATIONAL INC.

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	SECTION B - SUPPLIES OR SERVICES AND PRICES/COSTS				
0005AC	FUNDING - THIRD REVIEW PERIOD NOUN: AWARD FEE - THIRD REV. PRON: A126M57947 PRON AMD: 03 ACRN: AW AMS CD: 27373533000 Inspection and Acceptance INSPECTION: Origin ACCEPTANCE: Origin Deliveries or Performance DLVR SCH REL CD: 001 — QUANTITY: 0 — PERF COMPL DATE: 31-MAY-2002 $ 3,199,789.00				$ 3,199,789.00
0005AD	FUNDING - FOURTH REVIEW PERIOD NOUN: AWARD FEE - FOURTH REV. PRON: A136M56647 PRON AMD: 01 ACRN: BB AMS CD: 27373533000 Inspection and Acceptance INSPECTION: Origin ACCEPTANCE: Origin Deliveries or Performance DLVR SCH REL CD: 001 — QUANTITY: 0 — PERF COMPL DATE: 30-NOV-2002 $ 2,106,565.00				$ 2,106,565.00

B-1

The Government shall provide funds under this contract covering the estimated cost and fee on an incremental basis as provided for in the following schedule and pursuant to the Clause entitled Limitation of Funds. It is estimated that the incremental amounts are sufficient for the performance of work in each of the cited periods. The Government may, at its discretion, provide funds on an incremental basis within each fiscal year. The contractor shall so plan and execute the work required by this contract so as to expend and/or commit funds compatible with the proposed schedule below. Whenever the contractor has reason to believe that funds obligated for any fiscal year are either insufficient or excessive for the performance of work required in that fiscal year, the Government shall be notified.

Proposed Funding Schedule Requirements:

Performance Period	Amount
Total - FY00 - Award through Nov 30, 00	$ 14,105,855.00
Clin 0001	$ 12,621,985.60
Clin 0002	$ 913,992.20
Clin 0003	$ 569,877.20
Clin 0004	$ 0.00
Total - FY01 - Dec 01, 00 through Nov 30, 01	$ 71,048,514.80
Clin 0001	$ 54,199,177.90
Clin 0002	$ 6,443,561.80
Clin 0003	$ 5,113,694.10
Clin 0004	$ 0.00
Clin 0005	$ 5,292,081.00
Total - FY02 - Dec 01, 01 through Nov 30, 02	$125,777,437.63
Clin 0001	$ 92,175,879.50
Clin 0002	$ 13,327,150.00
Clin 0003	$ 3,535,037.80
Clin 0004	$ 0.00
Clin 0005	$ 5,306,354.00
Clin 0007	$ 11,433,016.33
Total - FY03 - Dec 01, 02 through Completion	$ 17,547,181.90
Clin 0001	$ 14,800,000.00
Clin 0002	$ 0.00
Clin 0003	$ 2,747,181.90
Clin 0004	$ 0.00
Clin 0005	$ TBD
Clin 0007	$ 0.00

The funding requirements lines above represent the total cumulative amounts by funding period and by line item for all awarded clins shown elsewhere in Section B of this solicitation.

NOTE; EFFECTIVE WITH MODIFICATION, P00016, THE CURRENT ESTIMATED CONTRACTUAL VALUES FOR CLINS 0001, 0002 AND 0007 ARE FULLY FUNDED THROUGH CONTRACT COMPLETION

*** END OF NARRATIVE B 001 ***

SECTION C - DESCRIPTION/SPECIFICATIONS/WORK STATEMENT

STATEMENT OF WORK

C.1 GENERAL:
The contractor, acting independently and not as an agent of the Government, shall design and develop an engine and any unique interfacing hardware for the Abrams tank (M1A1 and M1A2 SEP Models).

The design shall be fully validated and documented by a development program that, upon completion of the contract, shall result in Government approved performance specifications, ICDs, computer solid models, a set of contractor drawings (electronic format) and process sheets that will enable the procurement, production and acceptance of an engine that meets the following overarching program requirements when integrated in each vehicle.

a Reduced Total Ownership Cost: The goal is to achieve a Design to Operating Support Cost (DTOSC) of $41/hr for Abrams.

b. Satisfy Abrams Engine performance requirements referenced in Attachment 1.

c. Capable of being integrated into the Abrams Tank while minimizing changes to the basic platform or other subsystems.

d. Capable of being produced within a Design to Unit Rollaway Cost (DTURC) of $609,008 and of meeting the Abrams program test and production schedules at Attachment 3.

C.2 APPLICABLE DOCUMENTS:
The engine development specifications in Attachment 1 and Interface Control Documents (ICDs) at Attachment 2 provide the design baseline from which the contractor shall develop the objective engine configuration.

The contractor shall maintain and update such engine development specifications and ICDs throughout the development program in accordance with its Configuration Management Plan (CMP). As these documents evolve into the final production specifications, the contractor shall continuously coordinate with GDLS to assure that any planned design changes do not degrade vehicle system level performance. (Vehicle System Specifications are referenced in Attachment 1. Note that Abrams Vehicle system performance is subject to current performance waivers, deviations and letters of non-system conformance). Design changes/tradeoffs which impact any of the following items require Government approval prior to implementation: (1)vehicle system interface requirements; (2) power pack, propulsion system or vehicle system performance; (3) ERU/recuperator design or performance; (4) vehicle system size or weight (increases); (5) Or interfaces or performance of the engine.

In addition, the Contractor shall generate production level drawings and process sheets ready to be used for production orders once the individual hardware capabilities have been validated. These drawings shall be controlled in accordance with the contractor's CMP. All drawings shall be generated, released, reproduced and exchanged via an electronic system capable of exchanging all technical data.

The final specifications and ICDs to be delivered under this contract shall be validated through a contractor and Government test program using the prototype hardware.

C.3 PROGRAM MANAGEMENT (CLIN 001):
The contractor shall exercise the requisite planning, direction and control over the program to accomplish development objectives within performance, cost and schedule constraints including, but not be limited to: data management, scheduling, and an earned value management costing system that shall accurately and proactively report costs.

C.3.1 REVIEWS:
The contractor shall support and conduct the necessary meetings and reviews required to effectively manage the development efforts in an IPT environment with the Government, Suppliers and the respective system integrators. Such efforts include supporting (or conducting when appropriate) working level Technical Interchange Meetings (TIMs), monthly Program Management Reviews (PMRs), quarterly In-Process Reviews (IPRs) and annual System Level Reviews (SLRs) conducted by the Government Program Management Office and Abrams prime contractors. These meetings and reviews are conducted to manage the status of all facets of the program on a recurring basis.

C.3.2 INTEGRATED PRODUCT TEAM:
The Contractor shall participate in a streamlined Integrated Product & Process Development (IPPD) and Systems Engineering (SE) environment that integrates the product's design, development, integration, logistics, and manufacturing. The Contractor shall participate with the Government and the system's integrating contractors in an IPT. The IPT's primary responsibility shall be the timely identification and resolution of program and technical issues across all program functional areas.

The Contractor shall conduct a training course relating the theory of operation, component description, maintenance, servicing, troubleshooting, and repair. As such, this course "Government Test and Evaluation" is for the purpose of familiarizing Government personnel (i.e. - mechanics, technicians, engineers, etc.) with the operation and maintenance requirements of the engine.

C.3.3 INTEGRATED MASTER PLAN (CDRL 001):
The Contractor shall develop and deliver a comprehensive Integrated Management Plan (IMP) within 60 days after contract award. The IMP

shall describe the management processes and key events required to complete the systems design, engineering and integration efforts in accordance with the program objectives. The IMP shall provide a framework for implementing and measuring performance required at completion of those key events. Moreover, each task shall be accompanied by specific accomplishment criteria that shall be used to assess the completion of the task for a given event. At a minimum the IMP shall cover:

A description of 1) the technical and management processes for interfacing with the Army and the System Integration Contractor, and for ensuring the engine configuration is maintained, 2) an approach for managing requirements and interfaces across programs and contracts, 3) plans and processes for managing changes to requirements and interfaces, and 4) plans and processes for achieving issue resolution across programs and contracts.

The key technical performance measures (TPMs), supporting technical performance parameters (TPPs) to be tracked during development and "Success Criteria" for products to be delivered during the development phase (Phase I) and proposed "Transition Criteria" for transitioning from Phase I to the production contract (Phase II).

The program, technical, cost, and schedule risks for hardware and software, their risk ranking and the risk mitigation plans shall be proposed to reduce these risks early in the program. The risk assessment technique/methodology to be used to determine these risk ratings shall be fully described. The risk mitigation plans shall include specific risk reduction metrics (RRM) for measuring the progress/status of risk reduction initiatives. The Contractor's objective shall be to reduce all technical risks to "Low" by the conclusion of Phase I.

Processes shall be used for managing life cycle cost (LCC) in order to minimize the Army's total ownership cost (TOC). The Contractor shall use Cost as an Independent Variable (CAIV), Design to Unit Rollaway Cost Objectives (DTURC), and Operations and Support (O&S) cost objectives along with appropriate glide paths to manage program activities.

The Contractor shall manage engine weight. The weight program shall differentiate between estimates, calculations and actual measurements of similar and identical parts, and evaluate risk in accordance with these computational types. Design-to-weight objectives shall be assigned and managed throughout the development phase.

The method to be used for managing Reliability, Maintainability and product Durability; "R/M/D" objectives shall be established and managed throughout the development program. Growth curves shall be established with projected glide paths and planned activities for achieving these targets.

C.3.4 INTEGRATED MASTER SCHEDULE (CDRL 002):
The Contractor shall develop an Integrated Master Schedule (IMS) that defines the time phasing of key program tasks, events, milestones and their interdependencies. The IMS shall be used to assess program status and conduct schedule planning, critical path and risk assessments. The IMS shall identify long lead items (LLI) that drive development and procurement time lines and all major milestones leading to production deliveries. The LLI list shall define those parts and components whose procurement times exceed 120 days, and shall be maintained throughout the program. This list shall include information on estimated cost and lead-time for each item. During program execution, the IMS shall be updated on a monthly basis to accurately reflect the established development plan and status.

C.3.5 EARNED VALUE MANAGEMENT:
The Contractor shall prepare and submit a monthly Cost Performance Report (CPR) (CDRL 003), and quarterly Contract Funds Status Report (CFSR) (CDRL 004). The CPR shall be submitted using DO-MGMT-81466 as a guide, and shall report costs through the third level of the WBS. This report shall clearly present the Contractor's progress against its Performance Measurement Baseline (PMB), provide insight as to the cumulative variances in the CWBS legs, and report on the usage of Management Reserve. The earned value management system shall conform to the criteria set forth in the EVMS ANSI standard (ANSI/EIA-748-1998) for Defense Acquisition. The report shall be broken out to the third indenture level (at a minimum). The CFSR shall be prepared and submitted using DI-MGMT-81467 as a guide.

The Contractor shall electronically produce contract cost data in accordance with the Contractor Cost Data Reporting Manual.

The Contractor shall generate a WBS (using MIL-HDBK-881 as a guide) and a WBS Dictionary that describes each and every WBS element. The Contractor shall ensure that all subcontracted effort is included within the WBS, as shall all contract effort. All Contract Change Proposals and Supplemental Agreements shall be subjected to the same level of WBS identification, definitions, and SOW relationships as the basic contract. The WBS shall be used for planning, managing and reporting program status and projections for cost, schedule and technical achievements. The Contractor shall make no changes at or above the third level of the WBS (fourth level for CLIN 0001, Leg 1.1 only) without government approval.

The Contractor shall develop a detailed Performance Measurement Baseline (PMB). Updates shall be made during the program per the Contractors EVMS description. Within 120 days after contract award, the Contractor shall support an integrated Baseline Review (IBR) at its facility. At this time, the Contractor shall generate a time-phased budget baseline assigning all contract costs to specific WBS elements. The PMB shall be the basis for the Cost Performance Report (CPR). No budgetary changes above the reporting level, with the exception of the allocation of management reserve, shall be made to the PMB once it has been approved, without prior Government notification.

C.4 SYSTEM ENGINEERING:

C.4.1 GENERAL:
The Contractor shall design and develop an engine that fully satisfies all of the requirements of this contract. The capabilities of this engine design shall be fully validated and documented by a development program that shall demonstrate full compliance with the Engine Specification, Interface Control Documents, and Production Drawings.

To ensure that technical, cost, and schedule risk is minimized, and the overall program objectives are satisfied, the contractor shall maintain a Systems Management approach utilized throughout the program. The Systems Management approach shall include a variety of multi-discipline individuals, who shall perform trade studies as required throughout the program to ensure that optimal product decisions are being made. The Systems Management approach, shall include, but not be limited to the following disciplines: Systems Engineering, Reliability Engineering, Maintainability Engineering, System Safety/Health Hazard Engineering, Survivability Engineering, Human Factors Engineering, Quality Assurance, Producibility (or Manufacturing Engineering), Configuration Management, and Environmental Engineering. At a minimum, the contractor shall perform trade studies to evaluate: cost, schedule, reliability, performance, and risk impacts to the program.

C.4.2 TECHNICAL ANALYSIS:
The engine and its constituent components shall be designed utilizing the latest computer modeling techniques, codes, processes and checklists that are employed by the Contractor. Analysis and evaluation of these components shall include but not be limited to: aerodynamic capability, structural integrity, reliability, maintainability, supportability, human factors engineering, quality assurance, producibility, hazardous materials, ILS and all appropriate interfaces. A concurrent engineering approach shall be used that ensures that all drawings have been reviewed in accordance with the contractor's configuration management plan by the appropriate discipline prior to drawing release. Each component performance level shall be routinely assessed against the overall system requirement.

Design reports shall be written to document the adequacy of each component. Aerodynamic, performance, lifing reports to include cyclic analysis, and containment analysis shall be performed on the compressor and turbine blades and disks. An Average Performance Model shall be generated that documents the average performance of the development engines. Additionally, a Minimum Performance Model shall be generated that documents the minimum performance levels of shaft horsepower and fuel flow/specific fuel consumption to be delivered to the Government. A computer model with user instructions shall be forwarded to the Government after adequate test hours have been accumulated to ensure accurate representation of the product.

To ensure that each component is properly reviewed for integration, a structural analysis of all pertinent casings, attachment points, interfaces and boundary conditions shall be performed. The structural analysis shall be performed with 2-D and 3-D modeling tools that account for thermal and mechanical loads as well as material property variations. All structural casings, whether they constitute outer engine shells or gearbox housings, shall be reviewed for structural capability. Shock loads, vibratory loads, transmission reactive loads as well as all rotor dynamic loading shall be analyzed to ensure adequate design and operation.

The Contractor shall develop and maintain detailed solid models to include dimensions, alignment, tolerances, assembly/attachment points, weight, density, moments of inertia and center of gravity information. Upon request by the Government, solid models of the exterior of the engine and adapter kit parts shall be converted to ProEngineer and delivered in accordance with the requirements and guidelines for solid modeling provided by the Government. GDLS shall be given pertinent data to roll-up the system model and conduct system integration assessments and analyses (e.g. interference checks, determination of vehicle center of gravity, dynamic modeling, etc.).

C.4.3 REQUIREMENTS AND CONFIGURATION MANAGEMENT:
All requirements shall be placed and managed in a program Requirements Traceability Management (RTM) database. The Contractor shall update a Requirements Compliance Matrix (RCM) on a regular basis to reflect the expected capability of the current design.

The Contractor shall prepare a Configuration Management Plan (CMP) (CDRL 006) and Software Development Plan (SDP) (CDRL 007). A software package shall be utilized to effectively communicate these requirements and their flow-down to members within the team.

The engineering data and related configuration documentation prepared by the Contractor shall reflect the product structure, as-designed configuration and as-built configuration for all deliverable hardware and software products. The Contractor shall prepare for and participate in annual CM reviews and audits to evaluate the effectiveness of the CM program and Software Configuration Management (SCM) process.

The Contractor shall execute parts control and standardization activities at the subsystem and sub-tier levels concurrent with the objective subsystem configuration. Additionally, the Contractor shall flow down parts control and standardization requirements to other contractors and vendors as required.

C.4.4 INTERFACE CONTROL AND MANAGEMENT:
Interface Control Documents shall be developed and maintained to: (1) describe all interface requirements (e.g., mechanical, electrical, hydraulic, software) between engine and vehicle system (B-Kit ICD), and (2) describe all interface requirements between the Abrams engine and any interfacing systems on the vehicle (adapter kit ICDs). The B-Kit ICDs are included in Attachment 2 of the contract. The

Abrams adapter kit ICDs shall be developed in conjunction with GDLS as the vehicle modifications and engine design matures (CDRL 008).

The ICDs shall be prepared in contractor format, subject to the approval of the Government. Once approved by the Government, the ICDs shall not be changed without written approval of the COR. The contractor shall maintain interface control and manage changes to these requirements and interfaces in accordance with the following requirements:

Physical Interfaces. The Contractor shall support the program Physical Interface Working Group and the physical interface change control process, and the creation and maintenance of interface documents to include mounting provision (MP) data sheets and power pack space claim models and hydraulic connections.

Electrical/Electronic Interfaces. The Contractor shall use the Cable Interconnect Diagrams (CID) and Component Data Set (CSD) databases to define electrical/electronic interfaces. The Contractor shall provide usage and interface data for all engine electrical/electronic components. Data shall be of sufficient detail and accuracy to support 1) generation of interface control documentation through the CDS database, 2) design of interface cabling, 3) design of interface control and power distribution circuitry, 4) verify use of Standard Electronics has been maximized, and 5) verify use of Common (electrical) parts has been maximized.

Electronic/Logic (software) Interfaces. The Contractor shall support the program Electrical System Interface Working Group (ESIWG) and electrical/electronic change control process, the program Software Interface Working Group and software interface change control process, and the program Automotive Controls Interface Working Group (ACIWG). The electronic hardware and software shall be made compatible with Abrams vehicle electronics architecture and software architecture interfaces. If under this contract, new software is developed or commercial off the shelf (COTS) software is modified by 35 percent or more, the Contractor shall follow a Software Development Plan that reflects its software life cycle processes and meets IEEE/EIA ISO 12207 as tailored by the IPT. The Contractor shall assure external interfaces are designed per the requirements of DOD Joint Technical Architecture (JTA).

The Contractor shall use models and simulations to emulate the signals and the data exchanged at electrical and logical interfaces of the power pack hardware and software. Models and simulations shall be used to replicated sub-system features for the purpose of early design iteration, interface definition and integration evaluation. The Contractor shall use these models and simulations to perform design analyses/validations, assess functionality and conduct performance measurements and predictions and assess timing and states/modes transition effects.

The Contractor shall use 1) Simulation, Emulation and Stimulation (SES) to achieve early verification and validation of electrical, electronic and software interfaces; and 2) Low Fidelity Models to verify and validate external powerpack interfaces early in development. The Contractor shall deliver simulators and emulators of the engine external interfaces and support integration of these products into GDLS' SIL. These simulators and emulators shall consist of both Contractor-developed software and GLDS-supplied hardware. Delivery of the emulators and simulators shall be achieved in order to support early integration of the engine electrical/electronic controllers with external vehicle interfaces.

C.4.5 NBC CONTAMINATION SURVIVABILITY (NBCCS):
The design shall satisfy the NBC Contamination Survivability (NBCCS) criteria for hardness, compatibility, and decontaminability specified in AR 70-75 and the quantitative NBC Survivability Criteria for Army Materiel (12 August 1991). Materials used in the design shall be selected accordingly.

The Contractor shall provide assistance to GDLS for the risk identification and NBCCS assessment of the engine design. This assistance shall include, but not be limited to: access to drawings, performance criteria, design parameters, specifications, Human Factors information, failures mode information, description of operation, and a list of materials. A list of non-NBCCS qualified materials used in the design shall be maintained and presented at regularly schedule IPRs and reviews. Material information shall be exchanged on a concurrent basis, to the maximum extent possible, so that GDLS can assist the Contractor on NBCCS aspects of the design.

C.4.6 EMBEDDED DIAGNOSTICS/PROGNOSTICS:
The Contractor shall develop an integrated diagnostic strategy (embedded and external) that defines the interface between the engine, its embedded software, the operator and the maintainer on a flow of information basis. The diagnostic strategy shall contain a logic decision tree that identifies a category of particular operator input and identifies steps to make a corrective or scheduled maintenance decision. The diagnostic strategy shall reflect categorical equipment differences and diagnostic approaches.

The engine shall have on-vehicle embedded diagnostics capability. The objective of the embedded diagnostics system shall be to improve maintenance and readiness, reduce operations and support costs and enable the Army's anticipatory logistics system.

The engine shall be capable of performing health monitoring and health checks using embedded resources of the weapon system to the maximum extent possible. This capability shall include system level diagnostics and fault isolation that integrates the engine with the platform. Weapon system on-board processing shall use data to provide the health check and fault isolation, and robust predictive and prognostic capability.

The design shall feature prognostic strategy whose primary consideration is condition monitoring of equipment and determination of prognostic results. The Contractor shall implement the prognostic strategy by incorporating prognostic sensors, wiring and software hooks for prognostic data collection and mitigation. At a minimum, the sensors listed in Attachment 5 shall be incorporated in the

system design.

C.4.7 MANUFACTURING ENGINEERING:
Drawings shall be prepared for all laboratory fixtures, test fixtures, and tooling that are required to support the program during Phase I and Phase II at the factory level. Additionally, the analysis required to support the selection of these designs and ensure their safety and functionality shall be performed. Special Test Equipment required to perform any tasks shall be identified and specified. Production Tooling shall be used to the maximum extent possible during the development.

A Production Transition Plan (CDRL 009) shall be developed by the Contractor that addresses subcontractor/vendor controls, critical materials and production lead times, make/buy trade plans, process and plant layouts, equipment, tooling, special test equipment and test capabilities, plant capacity, labor relations, workforce skills, workforce training and certifications, facility modernization, and computer aided manufacturing. Additionally, the plan shall address the functional requirements needed to establish a Depot overhaul/repair capability in conjunction with the Anniston Army Depot.

C.4.8 HUMAN ENGINEERING:

The human engineering design criteria of MIL-STD-1472 and MIL-HDBK-759 shall be used as guidance during the design activity.

C.4.9 SAFETY ENGINEERING:
The Contractor shall perform safety engineering for hardware and software to ensure that safety and health hazard requirements are met. The UDLP Integrated System Safety Program Plan (ISSPP) shall be used as a guideline for Abrams activities (MIL-STD-882C). The safety program shall be in accordance with applicable sections of the ISSPP. The contractor shall maintain and provide Government access to Material Safety Data Sheets, data needed to generate Safety Assessment Reports for delivery of prototype hardware to Government test sites and data needed to support System Safety Working Group Meetings.

C.4.10 ENVIRONMENTAL ENGINEERING:
The Contractor shall have an active environmental program that accomplishes the following: 1) aids in the compliance of applicable federal, state and local environmental laws and regulations in effect, 2) ensures no Class 1 Ozone Depleting Substances (C1ODS) or Cadmium plated parts are used in the performance of this contract unless otherwise approved. The Contractor shall additionally provide a list of materials and/or processes used in the manufacture or support of the product. Hazardous material management and pollution prevention plans shall be developed to minimize life cycle environmental impacts and to ensure minimum industrial pollution and hazardous wastes are generated in the engine design, development, production, test, operation, maintenance, demilitarization, and disposal activities. The Contractor shall support and provide information on the amount and disposition of hazardous materials and wastes and for integrating environmental impact and cost consideration issues into the systems engineering process. Material safety data sheets (MSDS) shall be provided for any mixtures or substances subject to FAR 52.223-3 and Federal Standard 313C and components recycled products and closed-loop recycling of items, such as batteries, shall be identified. The Contractor shall support and provide data for the statement required for testing, milestone decision review and type classification. Information to be supplied shall include: part weight, energy and water consumption, waste outputs, and environmental, safety and health costs. The Contractor shall submit environmental reports and logs to the State.

C.4.11 MAINTAINABILITY:
The Contractor shall provide 1) maintainability support to design reviews, formal and informal, including system level design reviews; 2) access to maintainability data (MTTR, MR fix forward, and pre-op and total PMCS) down to the LRU level to be used for system level maintainability modeling, which shall include corrective maintenance and scheduled maintenance; 3) access to maintainability prediction data to be used by GDLS for system level maintainability predictions.

C.4.12 RELIABILITY:
The Reliability engineering effort shall include the following, at a minimum:

1) Access to engine hardware and software reliability models and predictions to be used by GDLS for system level reliability modeling and predictions. This modeling and predictions shall be conducted, at a minimum, to the LRU level. Where possible, this reliability prediction data shall be based on demonstrated test or field operational data for the equipment or for equipment substantially similar to that proposed.

2) Access to expected engine failure modes to the LRU level, with probable causes for each. The list shall include the failure mode ratio effects, detection method, and compensation provisions for each failure mode. The sum of the failure mode ratios for the part or item shall equal one.

3) Reliability support of design reviews, reliability analysis questions/issues and failure scoring conferences;

4) Reliability growth support for planning, tracking and assessing power pack growth through development, which shall include growth curve documentation.

C.4.13 PRODUCT ASSURANCE:

All program activities shall be conducted in compliance with ISO 9001 requirements in accordance with existing Government / Contractor agreements. The contractor shall maintain a Quality Program Plan (QPP), a Software Quality Program Plan (SQPP) and acceptable product assurance procedures; and product quality metrics. Contractor Engineering and Operations personnel shall validate product specifications, witness software acceptance testing and review hardware drawings/software products.

The contractor shall support future Abrams production by implementing process control, inspection, final product acceptance and supplier control plans; managing material non-conformance/corrective actions; and maintaining quality records. The contractor will maintain inspection and acceptance test records, first article/first piece inspection results, and material/process certifications as specified in Contractor procurement documentation. The contractor shall specify sub-tier supplier quality requirements in procurement documents, define acceptance criteria, validate quality records conform to requirements, perform or witness acceptance tests, and perform source/receiving inspections. The contractor shall support requirements verification testing by validating results and participating on FRACAS review boards.

C.4.14 DRAWINGS AND TECHNICAL DATA:
The result of this system engineering effort, technical analysis and coordination shall be the generation of performance specifications, and drawings ready to be used for production orders once the individual hardware capabilities have been verified via development testing. All drawings and specifications shall be controlled in accordance with the contractor's ISO 9001 compatible configuration management system.

C.4.14.1 Performance Specifications: (CDRL 010) The contractor shall update (including adding QA and test requirements) the development specifications at Enclosure A to Attachment 1 to reflect the latest configuration throughout the development process. The development specifications shall evolve into a production specification that will enable the procurement, test and acceptance of production engines that reflect the validated configuration. The final production specifications shall be delivered in accordance with CDRL 010.

C.4.14.2 Drawings (CDRL 011): All drawings shall be generated, released, reproduced and exchanged via an electronic system capable of exchanging all technical data. Converted data is acceptable. Drawings shall be prepared and released that define all aspects of the engine design. The drawing effort shall include but not be limited to all detail part drawings, source control vendor drawings, section layout drawings, stack drawings, sub-assembly and top assembly drawings as well as an indentured parts list that fully defines every part required to manufacture the product. Further clarification on drawings and the TDP are defined in contract letters dated 24 Oct 2002, Subject: Definition and Delivery of Technical Data Package and 12 Feb 03, Subject: Authorization of Deviation and Clarification of Production Drawing Configuration, attached herein. The Contractor shall prepare and maintain technical data using MIL-DTL-31000 as a guide. Data shall include the Engineering Bill of Materials (EBOM), three dimensional solid models, two dimensional assembly and detail part drawings, test plans/procedures, detailed specifications, and any other information necessary to verify the engine, transmission, powerpack and propulsion system designs meet all requirements. These product drawings and associated lists shall be developed using MIL-STD-100G and ASME Y14.24M-1989 as guides. Drawings shall provide a level of detail and design disclosure equivalent to product drawings, as defined in MIL-DTL-31000. Drawings shall be identified with the Contractor assigned drawing number and CAGE Code. Product marking, based on the requirements of MIL-STD-130 shall be defined in the applicable drawing notes.

All physical interfaces shall conform to the International System of Units program requirements. All dimensions and tolerances used in reports, specifications and drawings developed under this contract shall be given in metric units unless otherwise approved. (Reference Contracting Officers letter dated 03 May 2001 for exceptions). The components shall be designed and produced in metric, unless there is a performance penalty, a cost penalty, or items are unavailable in metric, in which case soft conversion metrics are acceptable. Mill-run purchased materials and Commercial Off the Shelf (COTS) components are excluded from the metric requirement.

In addition, to the drawings required to fabricate the engine parts, the process sheets required to assemble and test the engine for production shall be prepared and released. These Manufacturing Operation Techniques (MOTs) shall be released during the development phase in the same format that they shall be ultimately used in production. A minimum of nine (9) of the eighteen prototype engines shall be produced and delivered by observing these MOTs.

C.4.15 Testability.
The contractor shall observe MIL-STD-1000 practices for the purpose of guiding design toward achievement of specified Power Pack testability requirements for Abrams.

C.5 INTEGRATED LOGISTICS SUPPORT (ILS):
The Contractor shall plan, implement, execute and manage an Integrated Logistics Support (ILS) program focused on design influence, development of support data, and preparation for supporting Abrams with an Integrated Life-Cycle Support Environment for engine development. The ILS program shall be structured to consider logistics supportability integrated with the design process. A maintenance concept that is consistent with the Army's Two Level Maintenance concept and uses Anniston Army Depot for Depot Level Repair shall be developed. On-board, built-in fault isolation/diagnostic/prognostic features shall preclude the need for any external engine test equipment at the tactical field level to the maximum extent practicable. Any external requirements for diagnostics shall be compatible with the Integrated Family of Test Equipment (IFTE) and Direct Support Electrical System Tests Sets (DSESTS). An approach shall be developed and implemented to meet the spare and repair part support requirements to comply with the Army's readiness goal of 90 percent.

The contractor shall develop and deliver preliminary technical data to include a Logistics Plan (CDRL 012), Logistics Support Analysis Plans and Records (CDRL 013), Technical Manuals / OEM IETM Source Data (CDRL 014), and Training (CDRL 015). All packing and container

design modifications needed to support the Engine effort shall be provided.

The Contractor ILS program shall focus on achieving a significant reduction in O&S costs while increasing end item readiness. A tailored LSA process shall be developed and implemented as the primary method for achieving these O&S cost goals. It shall use the former MIL-STD 1388-1A and MIL-STD 1388-2B as guides. The LSA process shall target identification of critical supportability requirements and resolution of potential problems through design solutions. An Integrated Support Plan (CDRL 012), that describes the ILS program, shall be supplied in contractor format in accordance with the Integrated Master Schedule.

The Contractor shall perform the LSA, addressing key support drivers, critical tasks, and source data for operator organizational and selected direct support level technical publications and training. As a part of the LSA process, the Contractor shall describe support/test equipment and special facilities requirements. The following LSA tasks shall be performed at the corresponding level of detail:

Standardization	- Define support-related design constraints based on standardization -Provide design recommendations for standardization approaches.
Design factor technological advancements and state-of-the-art design approaches which will enhance system support	- Influence hardware/software design, including support equipment, by identifying - Document and track specific design recommendations and improvements
Functional requirements Identification	- Provide listing of all tasks required to support hardware/software - Task list should be substantiated by RCM, FMECA, other analysis or specification
Support alternatives or simplify support resources	- Develop support alternatives to correct supportability design deficiencies and reduce
Alternatives/tradeoffs	- Include support considerations in all component level trade studies - Perform level of repair analysis - Document trade-off including assumptions
Task analysis tasks	- Perform detailed task analysis of crew/unit level task and onboard direct support
Test and evaluation	- Provide planning inputs to supportability demonstration

C.6 TEST AND EVALUATION

The contractor shall provide a joint Government/contractor test concept that: (1) meets the overall milestone schedules in Attachment 3, (2) validates the design with a high degree of confidence that the system meets the integration and performance requirements; placing particular emphasis on durability/reliability, and a low risk transition to production, and (3) takes advantage of common test data between the contractor and Army testing programs.

The approved test concept shall be reflected in detailed test plans (CDRL 016) for Abrams that shall specify the particulars of the engineering development tests, performance verification tests, and system verification tests necessary to verify engine, system characteristics and performance.

Test reports (CDRL 016) shall be prepared and provided to the Government within fifty days after the completion of each test identified in the test plan.

The contractor shall conduct testing to verify compliance of the engine with the performance and integration requirements prior to delivery of prototypes to the Government. The contractor's test effort should include a logical sequence of component, subsystem and system level hardware and software tests, including models and simulations to demonstrate acceptable system integration and compliance with performance and supportability requirements in the systems specification.

C.6.1. Engine Test Assets. The contractor shall manufacture a total of 18 LV-100-5 prototype engines for use as test engines. Nine (9) of these engines shall be production representative. These engines will be allocated as follows:

Six (6) engines with adapter kits will be used by the contractor to develop the LV-100-5 to meet Abrams performance requirements. These engines may vary in configuration due to the needs for instrumentation and development of various components. (See 6.2.1)

Two (2) engines with adapter kits will be used by the contractor for contractor endurance testing. The final endurance test engine shall be production representative (See 6.2.2).

One (1) engine with adapter kit will be shipped to the Abrams transmission manufacturer for use in developing the Abrams transmission.

This engine shall be production representative. (See 6.3.1)

Two (2) engines with adapter kits will be shipped to the Abrams vehicle integration contractor for use in the integration of the LV-100-5 engine into the Abrams vehicle. (See 6.3.2.)

Five (5) engines with adapter kits will be shipped to the Abrams vehicle integration contractor for installation into M1A2 Abrams SEP Tanks. These engines shall be production representative. (See 6.3.2)

Two (2) engines with adapter kits will be shipped to the Abrams vehicle integration contractor for use as test spares. These engines shall be production representative. (See 6.3.2)

C.6.2. Prototype Bench Testing. Prototype bench testing shall be divided into two different types of test, contractor development testing and contractor endurance testing. Accumulated engine run times shall be sufficient to support all of the program milestone objectives.

C.6.2.1 Contractor Development Testing. Six engines shall be used by the contractor to develop the LV-100-5 engine to meet Abrams performance requirements. The contractor will test these engines in test cells in accordance with the overall test concept plan. Tests to be accomplished with these engines include but are not limited to: controls testing, performance development, starting and operability, cold start and environmental testing, operation with multiple fuels, shock and vibration, steady state and transient operation, and evaluation of all sub-systems. Deficiencies found during this testing shall be corrected by the contractor and incorporated into the remaining prototype hardware and software.

C.6.2.2 Contractor Endurance Testing. Two engines shall be subjected to an endurance test consisting of the 400 hour NATO test for gas turbine engines, followed by 200 hours of transient cycling, followed by 100 hours of TACOM operational profile testing, followed by 200 hours of transient cycling and 100 hours of TACOM operational profile testing. Endurance Testing will be conducted in accordance with the Government approved test plan. Endurance testing shall be planned early in the program so that individual engines delivered to the field shall not acquire more operating hours than endurance engines.

C.6.2.2.1. First endurance Test. The first endurance test will be conducted as early as possible in the test program. This test is intended to increase the available knowledge about the performance of the LV-100-5 engine. Consequently additional inspections including partial tear down inspections at selected points in the test will be permitted. Changing of life limited parts during testing is permitted when the time at temperature meets the life limiting criteria after the 400 hour NATO portion of the test has been completed. Life limited parts are defined as turbine blades for the gas generator turbine and turbine blades for both stages of the power turbine. Success criteria shall be as defined in C.6.2.2.2. . At the completion of testing, the engine will be disassembled and inspected for wear patterns, weaknesses and/or incipient failures. Deficiencies found during this testing shall be corrected by the contractor and incorporated in the delivered prototype hardware and software. A test report will be prepared in accordance with CDRL 16.

C.6.2.2.2. Second endurance test. The second endurance test is intended to qualify the LV-100-5 engine for production. Consequently the test will be conducted strictly in accordance with the test plan and only non-intrusive inspections such as by bore scope will be permitted at specified intervals. Partial disassembly will not be permitted. Changing of life limited parts during testing is permitted when the time at temperature meets the life limiting criteria after the 400 hour NATO portion of the test has been completed. Life limited parts are defined as turbine blades for the gas generator turbine and turbine blades for both stages of the power turbine. Success criteria for the test shall be no minor test incidents during the 400-hour NATO portion of the test (as defined in NATO AEP-5 dated May 1988). For the remainder of the test, no major test incidents may occur during the test. A major test incident is defined as a power reduction in excess of 25% that cannot be recovered using normal maintenance techniques or a failure to start after 3 attempts. At the completion of testing, the engine will be disassembled and inspected for wear patterns, weaknesses and/or incipient failures. Deficiencies found during this testing shall be evaluated by the contractor to determine if a design change is required for production engines. A test report will be prepared in accordance with CDRL-16.

C.6.3. Abrams Deliverable Engines. Abrams deliverable engines are divided into two categories: engines used in the development of the Abrams power pack and engines intended for use in Abrams vehicles.

C.6.3.1. Abrams Power Pack Development. One engine shall be delivered to the transmission manufacturer for power pack development and testing. The transmission manufacturer will perform testing to verify the integration of the LV-100 engine with the Allison X-1100-6 transmission. Power pack testing will culminate with a 331 hour endurance test using the "Aberdeen cycle".

C.6.3.2 Abrams Vehicle Integration and Testing. Nine engines shall be delivered to the vehicle integrator for integration into M1A2 Abrams vehicles. The contractor shall support the integration and installation assessment in accordance with C.6.2.3. In that regard, the Government will use one of the prototype engines in a M1A2 SEP Abrams tank to evaluate the integration and installation of the system. Integration is defined as that portion of the non-recurring development program that involves packaging all the systems and subsystems of the propulsion system into a single concept that optimizes the system performance of the vehicle. Installation is defined as that portion of the recurring production or retrofit program associated with installing the propulsion system into the vehicle. The M1A2 SEP integration/installation will be evaluated by the Government in an Engineering tank located at the GDLS shop/software SIL facility.

One engine will be installed into a M1A2 SEP Abrams tank and used to evaluate the Logistics aspects of the installation at the GDLS shop/software SIL facility.

In addition, the contractor shall supply seven (7) production representative engines for vehicle and support testing at government test sites. Three (3) of these units will be used for Reliability/Durability endurance testing and will accumulate no less than 7500 Abrams OPMODE miles (750 engine hours) each. Two engines will be used for Engineering in-vehicle performance evaluation, one at APG and one at YPG. Two (2) engines will be used as spares. Operation in an extreme cold environment shall be evaluated in the cold chamber at APG as part of the performance test.

A maximum of two Abrams prototype sets of hardware may utilize parts that have been produced using development processes. The engines that utilize development processes shall be limited to the vehicle integration tests scheduled at GDLS. This shall ensure that all engines delivered for field tests or field test spares occurring with the tank vehicles utilize the production representative hardware.

C.6.3.3 Abrams Test Support. The contractor shall support power pack installation, integration and test at each site for each power pack asset. During testing, the contractor shall provide full engineering and logistics support to include spare/repair parts, tools, special tools, test equipment, maintenance support and failure analysis for the engine/power pack at Government test sites (Yuma Proving Ground and Aberdeen Test Center) as well as at the transmission manufacturer. The contractor shall also support vehicle chassis integration, assembly test and checkout (IAT&C) at the GDLS SIL and Logistic Center. The IAT&C will be performed to ensure the proper physical and functional integration of power pack hardware, electronics/firmware and software with the chassis and the vehicle, respectively. Contractor support during IAT&C shall include on-site engineering support to perform integration activities identified in the system test plan, troubleshooting/failure analysis and repair.

C.6.3.4 Failure Reporting and Corrective Action System (FRACAS): The contractor shall employ a FRACAS to maintain a history of test configurations, test results, test incidents and corrective actions for all contractor and Government testing identified in the test plan. FRACAS will be implemented for all engine, transmission and power pack testing. The contractor shall record test incidents during all contractor testing and make them available to the Government. During Government testing, the Government will use Test Incident Reports (TIRs) and Corrective Action Reports (CARs) in the Government Army Test Incident Reporting System (ATIRS) database. For developmental configuration testing, the contractor's internal FRACAS is acceptable; for Abrams production verification , the contractor shall use ATIRS. The contractor shall establish a Failure Review Board (FRB) to provide a technical forum for review and resolution of hardware and software failures.

C.7 Reserved

C.8 Engine Mock-ups and DECUs & Simulators

C.8.1 Engine mock-ups: The contractor shall deliver an LV100-5 mock-up engine. At a minimum the mock-ups shall have the following level of fidelity:

Interface Fidelity - Electrical, fluid and physical interface connections will be full fidelity.

Connector Fidelity - Electrical connectors shall be of representative size and location; however, internal detail pins or sockets may not be present.

Fluid Port Fidelity - Male and female fluid interfaces shall be of representative size and location.

Interface Robustness - Fluid and electrical connections shall be of sufficient strength to accommodate moderate loads imposed by the connection of mock-up electrical harnesses and hydraulic tubes. Mechanical interfaces shall be of adequate strength to support mock-ups of mechanical components which attach to these interfaces.

Non-Interface Feature Fidelity - All features will be placed within the spaceclaim envelope. The size and location of major components shall be within plus or minus 6 millimeters (.237"). External harnesses, tubing, brackets may not be in their final locations.

Handling Robustness - An engine mount and lifting provisions shall be provided with sufficient strength to support lifting and installation of the mock-up without damage. Additionally, the entire mock-up will be designed with sufficient strength to provide a 4:1 safety factor.

Mass Properties Fidelity - The weight and center of gravity of the mock-up will not be representative of the actual engine.

Material Properties - The mock-up will be constructed primarily from mahogany and aluminum. All mechanical interfaces will be made from metal.

C.8.2 FADEC,DECU & Simulator Requirements

C.8.2.1 Crusader Requirements- CLIN 0003- The contractor shall reallocate FADEC Serial Number R-10 and deliver it to GDLS-Tallahassee

for MCU integration and check-out. The FADEC shall be to the latest configuration prototype (including the End Cap assembly and all Circuit Card Assemblies) with required software. Additionally the contractor shall deliver to GDLS one spare LV100 engine simulator to enable functional testing of the FADEC within the Crusader MCU and in the Crusader SIL lab. The FADEC and engine simulator are being developed/manufactured under other requirements of the LV100 contract.

C.8.2.2 Abrams Requirements- CLIN 0002- The contractor shall reprogram and deliver DECU-100 Serial Number R-13 to GDLS SIL to support integration testing. Additionally, the contractor shall deliver to GDLS one spare LV100 engine simulator to enable functional testing of the DECU-100 within the Abrams SIL. The DECU- 100 and Engine simulator are being developed/manufactured under other requirements of the LV100 contract.

C.9. DECU-100- CLIN 0007

C.9.1 General

C.9.1.1 The contractor shall design a common DECU-100 to be compatible with both the LV100-5 engine and the AGT1500 engine. The current Digital Electronic Control Unit shall be used as the baseline. The DECU-100 is an assembly of printed circuit boards installed into a stand alone enclosure for the Abrams installation (DECU-100). The DECU-100 Line Replaceable Unit (LRU) will be directly interchangeable with the J5.5 and J6 DECU LRU configurations without any engine (AGT 1500 Engine) or tank modifications, when loaded with the AGT1500 DECU-100 software.

C.9.2. Design and Development

C.9.2.1 The FADEC/DECU-100 Requirements Document at Attachment 1 provides the design baseline from which the contractor shall develop the objective DECU-100 configuration for all approaches. The contractor shall maintain and update the FADEC Requirements Document in accordance with C.2 of the SOW. Final delivery of the Requirement Document shall be in accordance with CDRL 010. The DECU-100 shall use commercial off the shelf or existing military chips wherever possible. The contractor shall develop the following to support the LV100 and AGT 1500 Engines:

a. Common DECU-100 hardware
b. LV100 Unique Hardware required for the Abrams Tank Installation
c. AGT 1500 Unique Hardware with a diagnostic display module and Software (incl. CANBUS)
d. All software for all vehicle configurations shall reside within the DECU-100 assembly.
e. Digital Memory Module (DMM) for the LV100 Engine only
f. The DECU-100 design shall not preclude the future enhancement of a heater card for the DECU-100, (Pre-Planned Product Improvement (P3I)

C.9.2.2 The contractor shall provide an initial software development release. This includes validation testing and documents of the full suite of DO-178B qualification testing to include the following:

a. Test Case Development
b. Test Procedure Development
c. Structural Coverage Analysis
d. Internal Test Readiness Review
e. Customer Test Readiness Review
f. Test Execution and Test Report Production

C.9.2.3. During the prototype testing, the contractor shall update the software development release and conduct the full testing required to validate the requirements of DO-178B level C for engine control software and DO-178B level D for diagnostics and prognostics software. Final validated software packages shall be provided to the Government within 60 days following completion of the testing. This will include electronic media master copies for Government use to down load into the Direct Support Electrical System Test Set (DSESTS).

C.9.2.4. When selecting components for the DECU-100, the contractor shall coordinate with the White Sands Missile Range to maximize the selection of components already tested and approved as Nuclear Hardened Critical Item (HCI) components.

C.9.3 Prototype Hardware (Fabrication)

C.9.3.1. In addition to the DECU-100 prototypes required under CLIN 0002, the contractor shall fabricate four (4) sets of prototype hardware for the AGT 1500 engine with the latest software release.

C.9.3.2 The contractor shall fabricate one (1) additional prototype DECU 100 for support to the Abrams LV100 engine. This DECU 100 will be used for development of the Abrams Direct Support Electrical Test System (DSETS) Interfaces.

C.9.3.3 The contractor shall provide software as required to support integration testing. All hardware specifically applicable to CLIN

0002 (FADECs, DECUs, DMMs) shall be delivered with and billed against CLIN 002. . All other costs, to include testing hardware, AGT 1500 hardware, Engineering cost, etc shall be delivered (as required) and billed against CLIN 0007.

*** END OF NARRATIVE C 001 ***

Status	Regulatory Cite	Title	Date
C-1	52.204-4003 (TACOM)	START OF WORK MEETING	MAY/2000

The contractor shall host a start of work meeting at its facility, unless some other location is designated in the contract, within 30 days after contract award. The contractor shall at a minimum invite the Contracting Officer's Representative (COR) identified in Section G or in an appointment letter, the Contract Specialist identified on the face page of this document, and the Administrative Contracting Officer (ACO). The COR, Contract Specialist, and ACO shall be given at least 14 days advance notice of the time, date, and location of the start of work meeting. The preferred method of notification is by email.

(end of clause)

C-2	TACOM	SUPPLEMENTAL STATEMENT OF WORK: TAILORING OF MIL-L-61002 TO ELIMINATE USE OF CIODS	JUL/1995

The following change applies to MIL-L-61002, Amendment 1, dated 10 Jan 92, which is part of the technical data package (TDP) or specification for this contract. Paragraph 4.6.3.2 requires immersion testing in methyl chloroform, a Class I Ozone-Depleting Substance, or CIODS. Therefore, in order to eliminate the use of CIODS, MIL-L-61002 is changed as follows:

When meeting the requirements of MIL-L-61002, Amendment 1, delete the immersion testing requirements of paragraph 4.6.3.2.

(End of clause)

C-3	TACOM	SUPPLEMENTAL STATEMENT OF WORK: TAILORING OF MIL-STD-129 TO ELIMINATE USE OF CIODS	JUL/1995

The following change applies to MIL-STD-129M, dated 15 Jun 93, which is part of the technical data package (TDP) or specification for this contract. The following references to Class I Ozone-Depleting Substances, or CIODS, are part of MIL-STD-129M:

a. Paragraphs 3.27 and 3.28 reference MIL-P-116;

b. Paragraphs 5.1.1.2 and 5.1.1.3 reference MIL-C-46168 and MIL-C-53039;

c. Numerous paragraphs require labels per MIL-L-61002.

Therefore, in order to eliminate the use of CIODS, MIL-STD-129M is changed as follows:

a. For paragraphs 3.27 and 3.28, comply with MIL-P-116J, Amendment 2, dated 18 Aug 93.

b. For paragraphs 5.1.1.2 and 5.1.1.3, comply with both MIL-C-46168D, Amendment 3, dated 21 May 93 and MIL-C-53039A, Amendment 2, dated 19 May 93.

c. For paragraph 4.6.3.2 of MIL-L-61002, Amendment 1, dated 10 Jan 92, delete the immersion testing requirements for all references to MIL-L-61002.

(END OF CLAUSE)

C-4	52.239-4001 (TACOM)	YEAR 2000 (Y2K) COMPLIANCE	MAY/1999

(a) In the event that this contract calls for the delivery of any data processing hardware, software and/or firmware (to be referred to as information technology), such deliverables shall be required to perform accurate date/time processing involving dates subsequent to December 31, 1999. The information technology shall be Year 2000 compliant upon delivery.

(b) Definition. Year 2000 compliant means information technology that accurately processes date/time data (including, but not limited to, calculating, comparing, and sequencing) from, into, and between the twentieth and twenty-first centuries, and the years 1999

and 2000 and leap year calculations. Furthermore, Year 2000 compliant information technology, when used in combination with other information technology, shall accurately process date/time data if the other information technology properly exchanges date/time data with it.

(c) If this contract contains another provision requiring Y2K compliance, that provision shall take precedence.

(End of clause)

SECTION G - CONTRACT ADMINISTRATION DATA

LINE ITEM	PRON/ AMS CD	ACRN	OBLG STAT/ JOB ORD NO	PRIOR AMOUNT	INCREASE/DECREASE AMOUNT	CUMULATIVE AMOUNT
0005AD	A136M56647	BB	2	$ 0.00	$ 2,106,565.00	$ 2,106,565.00
	27373533000		3GA566			
				NET CHANGE	$ 2,106,565.00	

SERVICE NAME	NET CHANGE BY ACRN	ACCOUNTING CLASSIFICATION		ACCOUNTING STATION	INCREASE/DECREASE AMOUNT
Army	BB	21 32040000035R5R02P2737352516	S2011336M566	W56HZV	$ 2,106,565.00
				NET CHANGE	$ 2,106,565.00

	PRIOR AMOUNT OF AWARD	INCREASE/DECREASE AMOUNT	CUMULATIVE OBLIG AMT
NET CHANGE FOR AWARD:	$ 222,761,074.33	$ 2,106,565.00	$ 224,867,639.33

SECTION H - SPECIAL CONTRACT REQUIREMENTS

H-24 Design To Unit Rollaway Cost (DTURC) and Design to Operating and Support Cost (DTOSC)

The control of production unit costs of the engine and the operation and support cost of the engine (after fielding) are of paramount importance in achieving program objectives . Cost is a key design parameter and needs to be addressed on a continual basis during this common engine development contract. The goal is to achieve a balance between production costs and operating and support costs in order to obtain the lowest overall life cycle costs.

The objective of this contract is to develop an engine that will power the Abrams Tank and Crusader and meet the System Specifications. During the common engine development effort, the contractor shall continually strive to reduce the production unit costs of the engine and the operation and support cost of the engine after fielding. The DTURC goal for the first production lot is $790,855. for Abrams and $620,775. for Crusader. The DTURC goal for the entire estimated production buy of 3,600 engines (2,845 Abrams and 755 Crusaders) is $609,008. for Abrams and $580,043. for Crusader. The DTURC includes the contractor's recurring hardware production costs. Cost elements should include; labor, material, purchased parts, subcontract cost, burden, G&A, and profit. The DTURC is based on approximately 400 engines per year for Abrams and 140 engines per year for Crusader. The DTURC is in fiscal year 2003 dollars and uses the Office of Management and Budget (OMB) inflation guidance for Weapon Track Combat Vehicles (WTCV) dated 03 Jan 2000. The DTURC needs to track with the first production lot.

The DTOSC goal for Abrams is $41. per hour based on (see notes) and $23. per hour based on (see notes) for Crusader, and includes repair parts costs and petroleum oil and lubricants. The DTOSC is based on Amendment 5 O&S cost assumptions LV100 A & B kits, average through 2030, spares, repairables and POL. AWCF based on % of spare cost, excludes special causes.

The DTOSC is in fiscal year 2003 dollars and uses the OMB inflation guidance for Operations and Maintenance (OMA), dated 03 Jan 2000.

A DTURC and DTOSC report will be provided by the contractor on a quarterly basis. The cost report will be a means by which the Government will track and evaluate the contractor's progress toward achieving their DTURC and DTOSC goals. The contractor will document the rational for any variances from the goals and will take actions to rectify any variances not beneficial to the Government. The award fee in H-25.2.2-1 will be tied to how well the contractor demonstrates their progress towards and the achievement of the DTURC and the DTOSC goals. Final determination of the achievement of the DTURC goal will be made with the submission of the contractor's first production proposal. Development test results will be used to evaluate the achievement of the DTOSC.

Nothing herein shall be construed as obligating the government to award any production contract.

*** END OF NARRATIVE H 001 ***

H-25 AWARD FEE PROVISION

1. General Instructions

(a) The award fee provisions contained herein, and the administration of these provisions by the Government are not subject to the Dispute Clause of this contract.

(b) An Award Fee Review Board (AFRB) will be appointed to evaluate performance and determine the amount of award fee earned. Such evaluation board will consist of PM Abrams and the Contracting Officer. The evaluation performed by the Board and the resulting award fee amount shall be reviewed and approved by the Fee Determining Official (FDO) 30 days after the end of the review period.

(c) It is the intent of the Government to conduct an evaluation to determine the amount of any award fee earned, on a semi-annual basis in accordance with the review periods listed below. The Procuring Contracting Officer (PCO) intends to provide the contractor the award fee criteria for each period prior to the start of the review period. To achieve the maximum impact of the award fee pool, currently valued at $6,407,801.00, the contractor will be given an opportunity to assess that criteria and its priority or importance and provide input to the Government for consideration. In the event that mutual agreement is unobtainable, the Government retains the right to unilaterally adopt the criteria to be used during that review period. The Government reserves the right to unilaterally change the award fee evaluation criteria, period duration, distribution of remaining award fee dollars, and other matters covered in this plan, by written notice from the PCO to the contractor prior to the start of any review period. Changes to the plan for the current period will be subject to mutual agreement between the Government and the contractor.

H-25.1 REVIEW PERIODS

Review Period	Award Amount Available
#1 Award - 31 May 2001	$3,034,015.
#2 01 Jun 01 - 30 Nov 2001	$3,069,089. + $728,164 (rollover)
#3 01 Dec 01 - 31 May 2002	$3,203,863. + $811,023 (rollover)
#4 01 Jun 02 - 30 Nov 2002	$3,203,901.
#5 01 Dec 02 - 31 May 2003	$3,203,900.
#6 Final Overall Assessment 01 Jun 03 - Contract Completion	$1,530,097. - Subject to para. (a) below

(a) Unearned award fee, or a portion thereof, may be rolled forward to a Final Overall Assessment Award Fee Pool at the discretion of the Government. The Final Overall Assessment Award Fee Pool dollars may be earned at the completion of the contract based on an assessment of the Contractor's final performance against the overall program objectives in accordance with the following criteria:

Adjectival Rating	Range of Perf. Points	Description
Exceptional	(100-71)	The contractor exceptionally balanced cost, schedule and technical Performance in accordance with program priorities to achieve program objectives. Any deficiencies/shortfalls have little identifiable effect on overall vehicle system performance. Corrective actions have been identified, for any performance shortfalls, which can be remedied by first production unit without obsolescence. There is a strong likelihood that the DTURC and DTOSC goals will be achieved. Transitioning the program into production was considered to be a low risk.
Satisfactory	(70-30)	The contractor adequately balanced cost, schedule and technical performance in accordance with program priorities to achieve most program objectives. Any deficiencies/shortfalls have identifiable, but not substantial, effects on overall vehicle system performance. Remedial actions are required in one or more areas and may result in some obsolescence. The DTURC and DTOSC goals may be achieved. Transitioning the program into production was considered to be moderate risk.
Marginal	(29-0)	The contractor marginally balanced cost, schedule and technical performance in accordance with program priorities to achieve some program objectives. Deficiencies/shortfalls have identifiable and substantial effects on overall vehicle system performance. Corrective actions have been identified, for any performance shortfalls, which cannot be remedied by the first production unit without substantial investment and obsolescence. The DTURC and DTOSC goals will probably not be achieved. Transitioning the program into production was considered to be high risk.

The amount of unearned award fee after the completion of the fourth review period is $1,097,336. The amount to be carried over into the Final Overall Assessment Award Fee Pool is $715,000.

(b) At such time as the FDO should determine, a summary of the Government's evaluation of the contractor's performance for a given period utilizing the evaluation criteria contained herein, may be released and discussed with the contractor. The contractor may request, and the Government will provide, a formal debriefing on the AFRB's findings.

(c) The contractor may present a presentation (similar to IPR format) formally to the AFRB and other Government participants, which shall not exceed 120 minutes in length. If determined appropriate by the Contractor and/or the Government, this presentation shall include both the Contractor's and Government's perspective on performance during the evaluation period. The contractor may submit proposed criteria, through the PCO, within the area of emphasis, as well as other plan changes for the next period of performance.

(d) When it is determined that an award fee is applicable, any such amount shall be incorporated by contract modification. No award fee will be paid for any award fee review period in which the contractor receives an overall rating of marginal based on a weighted average of the three objectives, i.e. less than 30%. Moreover, the Government expects that all program requirements noted in C.1 will be achieved at completion of the contract. Accordingly, the Government will assess the overall status of contract performance to assure the contractor is maintaining a favorable balance between cost, schedule and performance across all program requirements while attempting to achieve exceptional performance related to the specific award fee criteria listed below.

(e) Nothing in this clause H.25.1 shall affect the payment of the base fee (3%). The Government shall make payments on account of the base fee equal to 3% of the amount of each invoice submitted by the Contractor and payable pursuant to the contract clause entitled

"ALLOWABLE COST AND PAYMENT" (apr/1998) FAR 52.216-7.

H-25.2 AWARD FEE AREAS OF EMPHASIS AND CRITERIA - Fourth Review Period

H-25.2.1 Program Objectives and Relative Weights:

Objective	Relative Weight - Value
1. Contract Schedule and Cost Control	50% of Award Fee - $1,601,951
2. Balancing Technical Performance	35% of Award Fee - $1,121,365
3. DTURC	15% of Award Fee - $ 480,585

H-25.2.2 Criteria for Critical Contract Requirements:

1. Contract Schedule and Cost Control. - 50% of Award Fee

Maintaining the development schedule has a slightly higher priority than cost. Therefore, when assessing cost and schedule performance the Government will weigh the contractor's progress in achieving the prototype delivery schedule listed in Section F of the contract higher than cost. The EVMS shall be used as a tool to assess and control cost and schedule. EVMS will be used to identify cost and schedule variances to include providing an explanation as to the extent/cause of any problem areas. Assessing earned value status will consist of determining whether BCWP accurately reflects work accomplished relative to the performance metrics inherent to the PMB. In addition, the timeliness and effectiveness of corrective actions will be assessed,

Exceptional: 71-100%

The contract is at or ahead of schedule and under planned cost for the work performed based on the information provided by the EVMS. There are no examples where significant management decisions have been made without due consideration of the impact on cost and schedule. BCWP accurately reflects performance according to metrics.

Satisfactory: 30-70%

The contract is on schedule and at planned cost for the work performed based on the information provided by the EVMS. There are few, if any, examples where significant management decisions have been made without due consideration of the impact on cost and schedule. BCWP reflects performance according to the metrics with minimal problems developing adequate metrics for work packages identified during planning.

Marginal: 0-29%

The contract is behind schedule and over planned cost for the work performed based on the information provided by the EVMS. BCWP reflects performance below the metric. Corrective actions are being implemented, with minimal assessment for timeliness and/or effectiveness. As detailed planning takes place, adequate metrics used for measuring performance are generally being developed.

2. Balancing Technical Performance - 35% of Award Fee

Areas of Emphasis:

Technical Performance Measure (TPM)	Threshold	Desired
Durability	1600 MTBF	3200 MTBF
Uninstalled Fuel Consumption	.393	.393
Uninstalled Max Horsepower	1494	1494

The Award Fee for technical performance shall be based on: (1) The contractors ability to exceed all of the threshold requirements listed above, and (2) The contractors ability optimize performance to the desired levels while achieving a favorable balance between the TPMs. The order of priority for balancing technical performance between the threshold and Desired levels is as follows: (1) Durability (Based on predicted MTBDR using the Abrams mission profile), (2) Uninstalled Fuel Consumption (Based on a worst case engine at 50% power), (3) Uninstalled Max Horse Power (Based on a worst case engine with Abrams adapter kit).

Exceptional: 71-100%

The data submitted clearly and convincingly shows that the contractors objective design has a high probability of exceeding all

threshold requirements by the beginning of the contract test program. The contractor is making significant progress in achieving the desired levels of performance while optimally balancing technical performance in accordance with program priorities.

Satisfactory: 30-70%

The data submitted clearly and convincingly shows that the contractors objective design has a high probability of exceeding most threshold requirements by the beginning of the contract test program. Any performance shortfalls are not significant enough to negatively impact a low risk Abrams Production Decision. Design improvements to achieve objective performance can be incorporated in prototype hardware in sufficient time to allow in-vehicle verification prior to production. The contractor is making adequate progress in achieving the desired levels of performance while adequately balancing technical performance in accordance with program priorities.

Marginal: 0-29%

The data submitted clearly and convincingly shows that the contractors objective design has a high probability of exceeding, some threshold requirements by the beginning of the contract test program. Any performance shortfalls are not significant enough to negatively impact a low risk Abrams Production Decision. Design improvements to achieve objective performance can be incorporated in prototype hardware in sufficient time to allow in-vehicle verification prior to production. Although some performance shortfalls may not be correctable in sufficient time to allow in-vehicle verification prior to a production decision, the design improvement(s) clearly have minimal impact and are clearly low risk for the first unit produced. The contractor has marginally balanced technical performance in accordance with program priorities while making limited progress in achieving the desired levels of performance.

3. DTURC 15% of Award Fee

The contractor shall implement Cost as an Independent Variable (CAIV) in managing/minimizing production costs. The contractor shall manage to the DTURC throughout development by tracking its progress against the goals and planned activities for achieving these goals.

Exceptional: 71-100%

The Contractor has clearly demonstrated a commitment to achieving the established goals. Specific and tangible results have emanated from its management processes. There are numerous examples where design and management decisions have been significantly influenced by the desire to achieve the goals. The contractor has demonstrated that it is tracking with its goals and planned activities to achieve the goals. There are no examples where significant decisions have been made without due consideration of the importance these goals.

Satisfactory: 30-70%

The Contractor has demonstrated a commitment to achieving the established goals. To some degree, tangible results have emanated from its management processes. While there are some specific examples where design and management decisions have been significantly influenced by the desire to achieve the goals, the majority of the results are somewhat intangible. There are some examples that the contractor is tracking with its goals and planned activities to achieve the goals, but overall, the results are inconclusive. There are few, if any, examples where significant decisions have been made without due consideration of the importance of these goals.

Marginal: 0-29%

The Contractor has a commitment to achieving the established goals but this has not yet been demonstrated by tangible results. There are few specific examples where design and management decisions have been significantly influenced by the desire to achieve the goals. Reported and observed results are nearly all intangible (i.e., theoretical, indefinite or vague). There are some examples that the contractor is tracking with its goals and planned activities and may achieve the goals, but overall, the results are immaterial. There are few examples where significant decisions have been made without due consideration of the importance of these goals.

*** END OF NARRATIVE H 002 ***

H-26 Option For Abrams Integration Work - Clin 0004AA

The Government hereby reserves the right to increase the scope of work (SOW) of this contract to include conducting a power pack test specification in Clin 0004 and setforth in Attachment 3 of this contract. The price of this option is setforth in Clin 0004AA. The option maybe exercised at anytime, but in any event not later than 450 days after award.

Prior to the expiration of the original option period identified above, the Government may seek a bilateral extension of the option period for an additional period not to exceed 90 days from the expiration date of the original option period.

H-27 Secure Environment Contracting

The Secure Environment Contracting (SEC) Procurement Contracting Officer for Special Access Programs (SAP) efforts under this contract is located in the SEC Cell at the U.S. Army Tank-automotive and Armaments Command, AMSTA-CM-ABGA, Warren, Michigan. Any contractual issues that need to address SAP information shall only be communicated to the SEC Procurement Contracting Officer, as he has the necessary clearances. If the contractor has any questions regarding the clearance of an individual, he must verify with the program security officer or the SEC Procurement Contracting Officer that the individual has the appropriate clearances.

*** END OF NARRATIVE H 003 ***